2016

ELECTRICITY
CHAPTERS 1,2,3 and 4
In the previous exams

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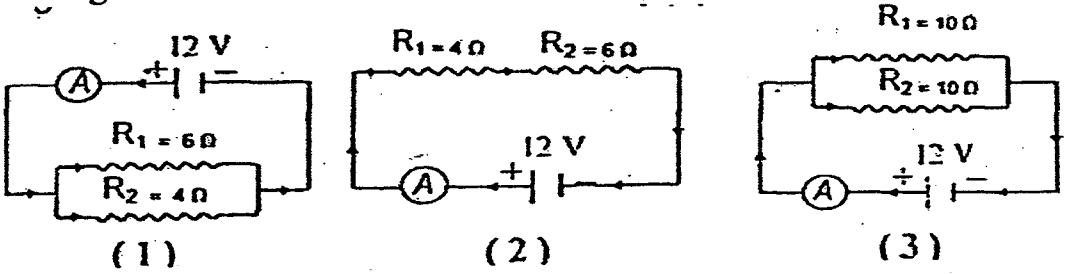
2006 First Session

Question (1) :

A- Mention one application of each of the following:

1-Eddy currents

B- The figure indicated three electric circuits (1),(2),and (3):



Firstly: Write the number of the circuit in which:

1- The current intensity flows in one of the two resistances differ than the other?

2- The ammeter reads high value.

Secondly: What will happen to the ammeter reading if the internal resistance of the battery is one Ohm?

Question (2)

B- Give reasons for each of the following:

3- The electrical conductivity of copper is high.

C- If the effective intensity of current in a circuit (I_{eff}) equals 2.828 ampere. **Find the value of each of the following:**

1 -The maximum value for current (I_{max}).

2-The instantaneous value of the induced current when the angle (θ) confined between the direction of velocity and the direction of the magnetic flux density = 30°.

How to measure the effective value of the intensity of the alternating current?

Question [4]

A- What is meant by.....?

3- The coefficient of self- induction for a coil equals one Henry.

C- A galvanometer has a resistance of 0.1 ohm, and a current of 1 mA is required for full-scale deflection:

Firstly: Calculate shunt resistance must be used to convert the galvanometer to an ammeter whose maximum range is 5 ampere. Mention how the shunt is connected.

Secondly: Calculate the multiplier resistance necessary to convert this galvanometer to a voltmeter whose maximum potential difference is 25 volt. Then mention how the multiplier resistor is connected.

Question (5) :

A- Compare between each of the following:

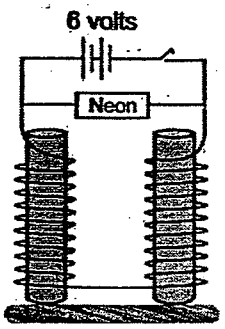
2- The physical relation used in calculating the value of the magnetic flux density at the center of a circular loop and at a point on the axis of a solenoid which the current traverse in each.

3- The number of turns of the primary coil and of the secondary coil in each of step-up transformer and in step-down transformer.

B- What will expect when it happens with interpretation when.....?

2- The replacement of the two metallic rings of the alternating current generator by metallic cylinder splatted into two halves insulated.

3- The electric circuit is switched off, which illustrated in the front of you.



Question [6] :

A- **Firstly:** Write the equivalent unit of each of the following, then mention the physical quantity which measure with each of:

2-N/A.m

C- The acting force (F) on a wire of 6 meter in length placed perpendicular to a magnetic flux is recorded when the current intensity (I) followings in the wire is changed ; So the results indicated in the followings table :

F Neweton	0.3	0.6	0.9	1.2	1.5	1.8
I Ampere	0.5	1	1.5	X	2.5	3

Draw the graphical relation between the force (F) on the y - axis and the current intensity (I) on the x - axis.

From the graph Find :

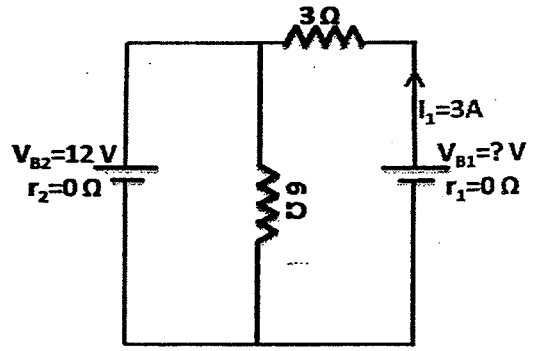
1-Magnetic flux density. 2-The value of X.

[Added] Egypt 1983: The resonant circuit of a receiver consists of a coil of inductance 10 milli-Henry, a variable condenser and a resistance of 50 Ohms. When the wireless waves of frequency 980 KHz fall on the aerial of this receiver, an induced e.m.f of 10^{-4} V is produced across the circuit. Find the value of the capacity required for resonance and the current produced in this case.

[Added] In the electrical circuit shown;
calculate:

i) The current passes through the 12V battery

ii) The e.m.f (V_{B1}).



2006 Second Session

Question One :

(C) A transformer of efficiency 80 % connected to a 200 volt AC power source, its e.m.f. 200 volt which gives 8 volt e.m.f. If the number of the turns of the primary coil 1600 turns and the intensity of current in the primary coil is 0.2 Ampere : Calculate :-

1 - The number of turns of the secondary coil.

2- The intensity of current in the secondary coil.

- Why there is no a transformer has efficiency 100 % efficient?

Question Two :

A- Mention the scientific interpretation for each of the following:

3- The iron core of DC motor is consisted of thin insulated sheets.

C- Three resistors (1,3,6) ohm are connected to an electric current source. The intensity of the electric current flowing through each resistor is (0.3, 0.2, 0.1) Ampere respectively **: Illustrate by drawing** how these resistors could be connected - **Then calculate** the total resistance of the electric circuit.

Question (3) :

B- Mention the physical relation used in each of the following and write the measuring unit used :

1- The electrical conductivity of a certain material.

3- The coefficient of mutual induction of the two coils.

C- If you have an electric generator of 100 turns, and cross sectional area of the coil is 0.025 m2. If rotates with frequency 700 cycles per minute in a magnetic field of flux density 0.3 Tesla. Calculate the induced emf when :

1- The plane of the coil is in a perpendicular position to the direction of the lines of the magnetic flux.

2- The angle between the direction of the coil plane and the lines of the flux is 90°.

Then compute the maximum induced $(\text{emf})_{max}$. $(\pi = 22/7)$

Question Four :

(A) Firstly : Give reasons for each of the following :

2- It is advisable to live away from high voltage towers .

Question Five :

C- Amilliammeter of resistance 4 Ohm has a coil capable of carrying a current of 30 milliampere. It is desired to use it as an ohmmeter using an electric cell of 1.5 V

having (.internal resistance 1 Ohm. **Calculate** the value of the requited standard resistor. **Calculate** the external resistance needed to make the pointer deflect to 10 milliampere.

Question Six:

A- Compare between:

2- Shunt resistance and multiplier resistor from the point of view of the method of utilization for each.

C- A straight wire of one meter length, carrying a current of 20 Ampere, is placed in an uniform magnetic field of flux density (B) , so the relation between the acting force on the wire by Newton (F) and the sinus (sin 6) angle between the direction of the field and the wire (sin θ) is indicated **by to the following table :**

F(N)	0.6	1.2	1.5	1.8	2.4	2.7	a
Sin θ	0.2	0.4	0.5	0.6	0.8	0.9	b

Draw a graph for the relation between (F) on the (Y) axis and (sin θ) on the (X) axis.

And from the graph find :

1- The magnetic flux density B.

2- Find the value of a , b when the wire is perpendicular to the magnetic field .

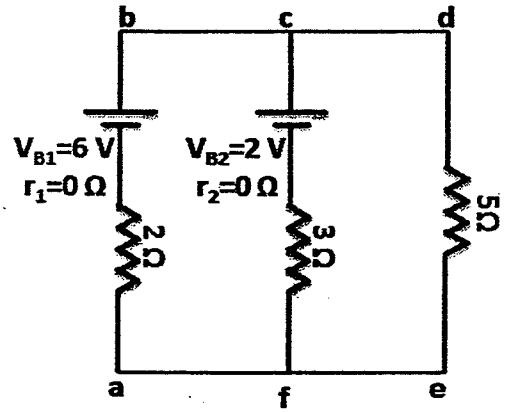
[Added] Egypt 1984: An AC series circuit consists of a resistance of 60 Ω and a coil of inductance $\frac{14}{55}$ H and an alternating source of a frequency 50 Hz. If the potential difference across the terminals of the resistance = 120 V, find the total potential difference across the terminals of the resistance and the coil together

[Added] SS' book:

In the illustrated electric circuit; find:

i) The current intensity in each branch

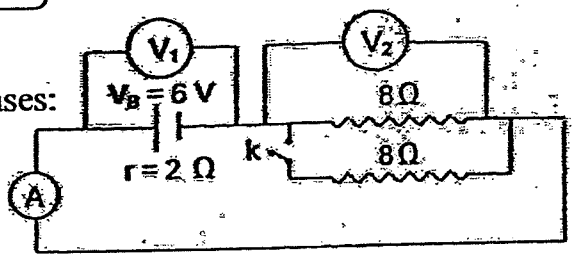
ii) The potential difference between a,b



2007 First Session

Question One :

C- In the circuit shown in the opposite figure.



Find the reading of A, V_1 and V_2 in the following cases:

1) k is opened.

2) k is closed.

Question Two :

A- Give reasons for each of the following :

2- A straight wire carrying an electric current does not move though placed freely in a uniform magnetic field.

3- The permanent magnet's poles of the moving coil galvanometer are curved .

Question Three :

A- Choose the correct answer from those between brackets:

3- The ratio between the number of coils to the number of segments of the commutator cylinder in the DC generator equals ..... ($\frac{1}{2}$ - 1 - $\frac{2}{1}$)

C- A galvanometer of coil resistance 250Ω and full scale deflection of 400 μ A is connected to a cell (1.5 V) and a fixed resistance 3000 Ω and variable resistor (R). **Find :**

1) The value obtained from the variable resistor to form an ohmmeter.

2) The value of a resistance connected to the terminals of the ohmmeter that causes the pointer deflects back to quarter of the scale.

Question Four:

B- Compare between each pair of the following:

1- The shunt and the multiplier from the point of view of its connection to the coil of the galvanometer.

3- Right hand screw rule and Fleming's left hand rule from the point of view of the function of each of them.

C- An electric current of intensity 5 amperes flowing through a coil of 500 turns produces a magnetic flux of 10^{-4} Weber. If the current vanishes in 0.5 second, calculate:

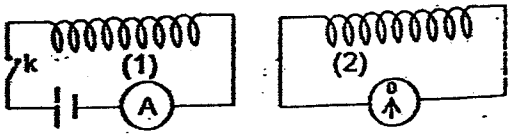
1- The induced emf generated in the coil.

2- The self induction coefficient of the coil.

Question Five :

A- In the circuit shown in the opposite figure, coil (1) is connected in series with a cell, a switch (k) and an ammeter.

Coil (2) is connected to a Centre Zero sensitive galvano



1- State and explain what will be observed on the readir galvanometer in **the following two cases** :

a- The instant of closing the switch (k).

b- A rod of soft-iron is inserted into both coils then the switch (k) is closed .

2- Mention the name of an apparatus whose operation principle is based on the above experiment .

Question Six :

B- What is meant by each of the following:

2) The copper resistivity = $1.8 \times 10^{-8} \Omega.m$

3) The magnetic flux density at a point = 0.4 Tesla.

[Added] Egypt August 1998:

An inductive coil of ohmic resistance 4Ω is connected in an electric circuit with an A.C source whose frequency (*f*) Hz can be changed, then measuring the voltage of the source, and the intensity of the current passing through the circuit one can calculate the inductive reactance (X_L) of the consider coil. The obtained results are tabulated as follows:_

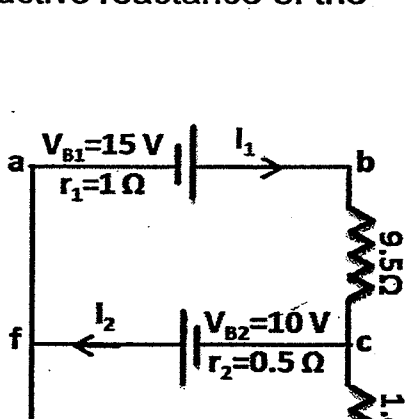
f (Hz)	7	14	21	28	35	42	Y
$X_L(\Omega)$	4.4	8.8	13.2	17.6	S	26.4	30.8

Plot a graph relating the frequency (*v*) Hz on the abscissa and the inductive reactance (X_L) Ω on the ordinate and then using the obtained graph find:

1. The values of S and Y
2. The self-induction of the coil L.
3. The capacity of the capacitor that if connected in the circuit with this coil makes the circuit at resonance when the inductive reactance of the coil is 30.8Ω

[Added] SS' book:

In the illustrated electric circuit find:
The current intensities I_1, I_2 and I_3



2007 Second Session

Question One :

A- Mention only one condition from those necessary for :

2- Obtaining attraction force between two parallel wires each carrying current.

C- A transformer is required to step up a voltage from 10 v to 50 v.

1- Is this possible with an AC voltage or a steady voltage ? Why ?

2- If this transformer has a primary coil consisting of 80 turns, how many turns are needed to be in the secondary coil assuming that the efficiency of that transformer is 100 %.

3- Suggest suitable materials which can be used to make each of the following the core of the transformer, the primary and secondary coils .

Question Two :

C- A coil with 25 turns of wire is wrapped around a hollow tube with a cross-section area 1.8 cm^2. Each turn has the same area as the tube. A uniform magnetic field is applied at right angle to the plane of the coil. If the field increases uniformly from zero to 0.55 Tesla in 0.75 second.

1- Find the magnitude of the induced emf in the coil.

2- If the resistance of the coil is 3 Ω , find the magnitude of the induced current in the coil .

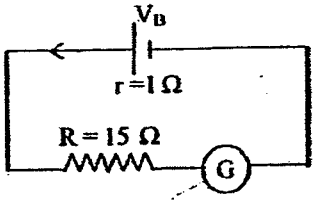
Question Three :

C- A battery of emf 8 volts and internal resistance 2 ohm is connected to a straight wire of length 20 cm , cross sectional area 3×10^{-8} m^2 and its resistivity 4.5×10^{-6} Ω.m. Calculate the magnetic flux density at a point which lies at normal distance of 10 cm away from the centre of the wire.

$$(\mu = 4 \pi \times 10^{-7} \text{ wb / amp.m})$$

Question Four :

C) The opposite circuit consists of a battery (V_B)and internal resistance 1Ω connected to a fixed resistor 15 Ω and a galvanometer of resistance 20Ω.



Find the ratio between the current passing through the circuit before and after connecting *a* shunt of 5Ω to the coil of the galvanometer.

Question Five:

(B) What's the scientific basis on which the function of each of the following depend

1- Induction furnaces.

2- Electric motor.

Question Six:

A) What is meant by each of the following ?

2- The work done to transfer an electric charge of 8 coulomb between two points in an electric circuit equals 64 Joule.

(B) You have a moving coil galvanometer of a resistance R_g ohms and the maximum current that can flow through its coil is I_g amp. Explain how can you use it as.

1- An ohmmeter to measure the value of unknown resistance.

2- A voltmeter to measure potential difference $V > V_g$.

Deduce the law used in the second case.

[Added] AL- Azhar 1984: A coil of reactance 250 Ω is joined in series with a resistance of 100 Ω and a variable condenser is connected to (200 volt alternating current at $\frac{1000}{44}$Hz) The current in the circuit arrives to its maximum value in this case **find:**

1) The capacity of the condenser

2) The potential; difference between each of the terminals of the coil and the condenser

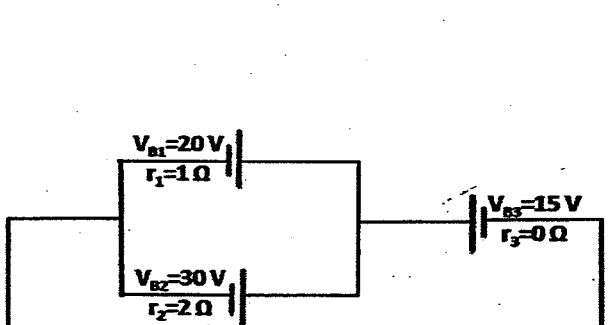
[Added] SS' book:

In the illustrated electric circuit; find:

i) The current intensity in each battery

ii) The potential difference across each battery

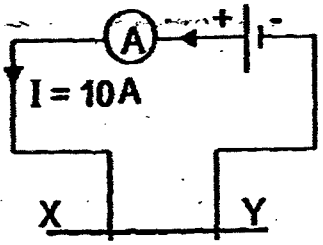
ii) The potential difference across the 5Ω resistor



2008First Session

Question Two:

C- An Aluminium wire XY of cross - sectional area 0.1 cm^2 is held horizontally while its terminals are in contact to the ends of an electric circuit as shown in the opposite figure. Find the direction and density of the magnetic flux that keeps the wires suspended without any external support



(ρ_{Al}= 2700 kg / m^3, g = 10 m / s^2)

Question Three

B -The opposite graph (1) represents the relation between the torque (T) which acts on a flat coil of (N) turns and area (A) rotating in a uniform magnetic field of flux density (B) and the angle (θ) between the normal to the coil and the magnetic flux lines. Find :

1) The value of T and 0 at the point A.

2) The value of T and 0 at the point C.

3) If the magnetic flux density (B) crossing the coil is changing with the time as shown in figure (2). Draw the figure in your answer book. On such figure sketch the variation of the (emf) induced in the coil with the time.

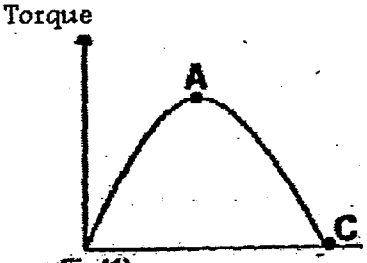


Fig (1)

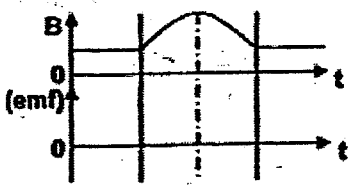


Fig (2)

Question Four:

A- Choose the correct answer from those between brackets for each of the following:

3) If the resistance of the coil of a galvanometer is R so the shunt resistance which reduces its sensitivity to 1/4 of its original value is

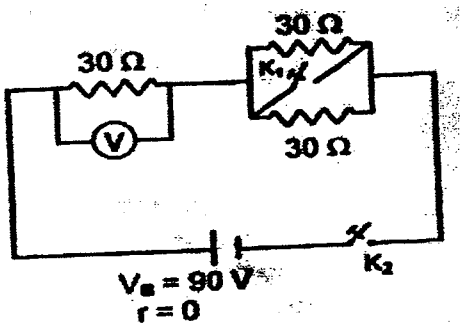
(R/4 - R/3 - R/2 - R)

C- In the opposite circuit. Find the reading of the voltmeter in the following cases:

1)K_2 is closed and K_1 is opened

2) K_2 is closed and K_1 is closed

3)K_2 is opened and K_1 is closed



Question Five :

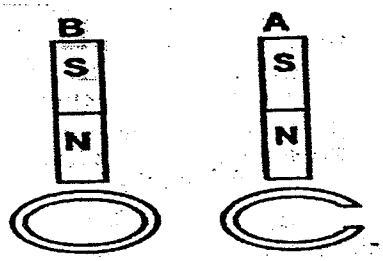
C- An electric transformer operates on potential difference 220 volts, has two secondary coils, one of them operates a small electric fan of (6volts, 0.4 amp.), the other operates electric recorder of (

12 volts, 0.35 amp.). If the number of turns of the primary coil is 1100 turns. Find:

1) The number of turns of each secondary coil.
2) The current intensity that flows through the primary coil that operating the electric fan and the recorder at the same time.

Question Six:

A- In the shown figure, two identical magnets fall freely downwards through two iron rings from the same height one of the rings is opened and the other is closed. Which of the two magnets reach to the surface of the earth before the other? Explain your answer.



[Added] Azhar1985:

A tuning circuit receives a wireless wave of frequency 750 KHz. when the capacity of its condenser is 40Pico Farad (PF). If the coil of the circuit is replaced by another one of inductance equals five times that of the first one, and the capacity of the condenser is increased **by** 32 PF, find the frequency of the wave which the circuit can receive in this case.

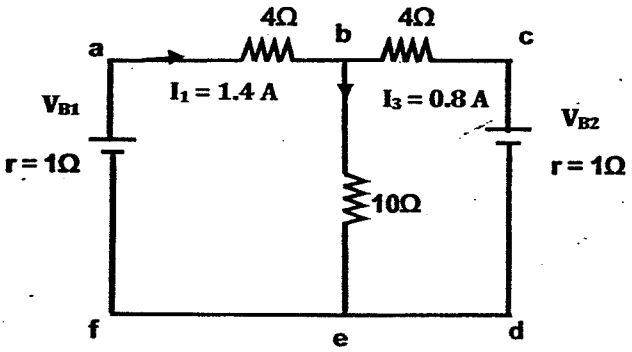
{remember :Pico means 10^{-12}}

[Added] SS' book:

Analyze the given circuit in the opposite diagram using Kirchhoff's laws to find:

a) V_{B1} and V_{B2}

b) The voltage drop across eb



2008 Second Session

Question One :

A) What is meant by:

1- The coefficient of self induction of a coil 0. 1 Henry

B) What will happen in each case and explain why

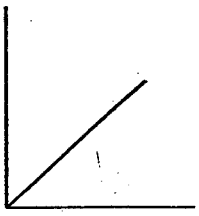
1- When increasing the current passing in primary coil inside the secondary coil whose terminals are connected to galvanometer (with the zero point at the middle of its scale).

2- Using direct e.m.f in the primary coil of the transformer.

3- Straight wire carrying a current is placed normal to a magnetic field.

Question Two:

A) Write the mathematical relation relating the variables of each graph



Question Three:

A) Give reasons for each of the following.

4- The galvanometer coil is connected to pair of spiral spring.

B) Explain how we can :

2- Increase the magnetic flux at the centre of a circular coil.

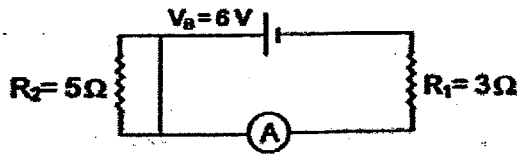
3- Produce a direct current from dynamo's coil.

Question Four:

A) Choose the correct answer from those between brackets:

2- In the following figure the reading of ammeter is

$$[\frac{1}{2}\ ;2\ ;\frac{3}{4}]\ Ampere$$



C) A milliammeter of resistance 4 Ω has a coil capable of carrying a current of 16 mA it is desired to use it as ohmmeter using an electric cell of 1.5 volt having internal resistance 1.75Ω. Calculate the required standard resistance and calculate the external resistance needed to make the pointer deflect to 10 mA ? Calculate the current that flows through it when connected to an external resistor 300 Ω.

\

Question Five:

C) A dynamo coil of length 40 cm and width 30 cm has 300 turns; it produces a current of frequency 50 /11 Hz if the effective value of e.m.f across its two terminals is $200\sqrt{2}$volt. Calculate

1- The maximum value of the induced e.m.f

2- The magnetic flux density

3- The maximum value of e.m.f when the coil rotates around an axis parallel to its length with velocity 3m/ sec.

Question Six:

A) Compare between each of the following:

4- Shunt and multiplier resistance from the point of view of the way of connection to the galvanometer and its use.

C) The table shows the relation between the length of a wire of cross-sectional area 0.1 m^2 and its resistance

Resistance R (ohm)	2.5	5	7.5	10	15
Length L(m)	5	10	15	20	30

Draw a graph relating the length [L] on the x-axis and its resistance [R] on the y-axis. From the graph find :

1- The resistivity of the material of wire

2- The resistance of a wire of length 25m

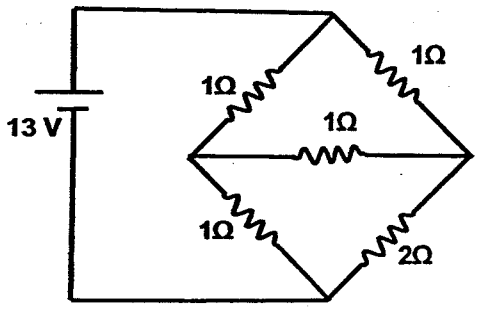
[Added] Egypt 1986:

Find the impedance to an AC of frequency 70 Hz in a series circuit that consists of a condenser of capacity 50/11 μF and a resistance of 100 Ω.

[Added] SS' book:

Find the equivalent resistance of the given resistance network using Kirchhoff's laws.

Ans.(1.18 Ω)



2009 First Session

Question (1)

A- Mention only one function for each of the following:

1. The large resistance connected in series with the coil of the sensitive moving coil galvanometer.
2. The transformer.

Question [3)

C- Three resistors (20, 40, 60) ohm are connected to an electric current source. If the potential difference across each resistor is (50, 20, 30) volt respectively, illustrate by drawing how these resistors could be connected. Then calculate the total resistance of the electric circuit.

Question (4)

B- Compare between:

1. The magnetic flux density at the centre of a circular coil and that at a point inside a solenoid on its axis from the point of view of its relation with the radius of turns.

C- A rectangular coil of dimensions 20 cm x 10 cm and of 200 turns placed in a regular field of magnetic flux density of 0.4 Telsa. A current of 3 Amp is passing through the coil. Calculate the torque acting on the coil in the following two cases:
First: When the coil plane subtends an angle 60° to the direction of the field;
Second: When the coil plane is perpendicular to the direction of the field.

Question (5):

B -1. Write down only one equivalent unit for each of the following, then mention the physical quantity measured by each of them: **Second:** Volt .sec/Amp

C- A current of intensity 4 Amp passes through an inductive coil of 800 turns to produce a magnetic flux density of 2×10^{-4} Weber. If the current vanishes in 0.08 sec. **calculate**: 1. emf induced in the coil.
2. The self inductance of the coil.
3. What is the rule used in determining the direction of the induced current in the coil.

Question (6):

A- Mention the scientific reason for each of the following:

1. Doubling the radius of a copper wire leads to decreasing its resistance to one quarter.

C- The following table represents the instantaneous values of the current generated by AC dynamo through a half revolution.

I Amp	0	3.6	6	8.3	10	12	10	6	3.6	0
t(m.sec)	0	0.5	1	1.5	2	3	4	5	5.5	6

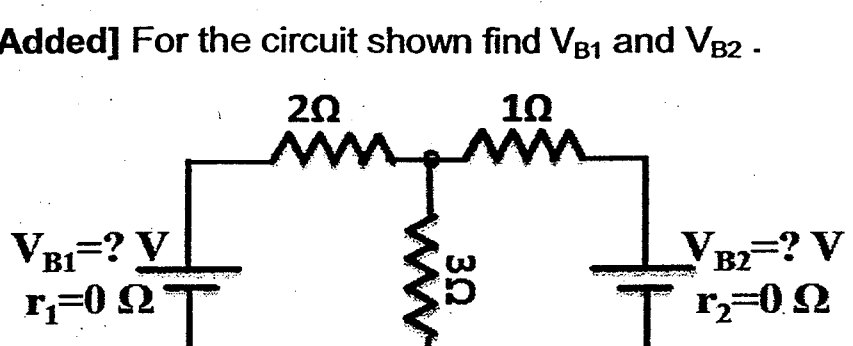
Draw the graphical relation through a half cycle such that **time is** presented on the x-axis, then find from the graph:

1. The periodic time. 2. The frequency.
3. The effective value of the current intensity.

[Added] Egypt, 1987: A coil of inductance 7/275 H and a resistance of 6 Ω. Find the current intensity in the coil when it is connected to:

a) An AC source of frequency 50 Hz and e.m.f. of 6 V.
b) A DC mains of voltage 6 V.

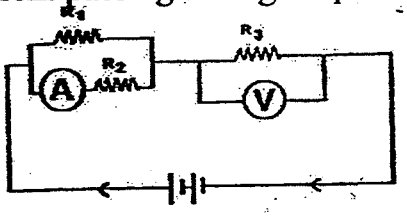
[Added] For the circuit shown find V_{B1} and V_{B2} .



2009 Second Session

Question (1)

C) The electric circuit shown in figure consists of $R_1 = 6\Omega$, $R_2 = 3\ \Omega$, $R_3 = 2\Omega$ and a battery whose internal resistance is one ohm. If the current passing through R_1 is 1 ampere, **calculate:**



1- The reading of the ammeter (A).
2- The reading of the voltmeter (V).
3- The emf of the battery.

Question [2]

A) Mention the scientific basis on which each of the following operates:

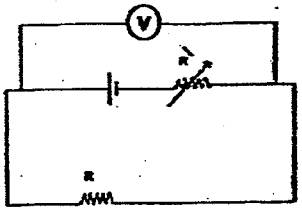
4- Electromagnetic induction furnaces.

B) The coil of a simple AC generator consists of (N) turns, the cross sectional area of each is (A)m^2. The coil rotates with constant frequency (F) HZ in a uniform magnetic field of constant flux density (B) Tesla. **Prove** that the instantaneous induced (emf) is given by the relation: emf = NBA $(2\pi f)$ sin $(2\pi f)$ t.

Question (3)

A) Choose the correct answer from those between brackets:

1- In the circuit shown in figure, if the resistance R' increases, the reading of the voltmeter will...(decrease , increase , remain constant)



B) Mention the function of each of the following:

3- The two spiral springs in the moving coil galvanometer.

Question [41

A) Give reasons:

3- The core in the transformer is made of thin insulated sheets of siliconic soft iron.

4- A movable rectangular coil carrying a direct current does not move when placed in a magnetic field.

Question (5) :

A) Compare between each of the following:

4- Lenz's rule and Fleming's right hand rule (concerning their uses).

B) What are the results of each of the following?

2- Replacing the two metallic rings in the AC generator by two halves of a metallic cylinder insulated from each other..

Question (6):

A) Mention one unit used for measuring each of the following physical quantities:

1 - Self induction coefficient of a coil.

2- The magnetic dipole moment.

C) A straight wire of length 1 m carrying a current of 10 A placed in a uniform magnetic field of flux density B (Tesla). The following table illustrates the relation between the force F (Newton) acting on the wire and (sin θ), where θ is the angle between the wire and the direction of the magnetic field.

F (Newton)	0.3	0.6	0.9	1.2
Sin θ	0.1	0.2	0.3	0.4

Draw a graph to show the relation between (F) on the y - axis and (sin θ) on the x-axis. From the graph find:

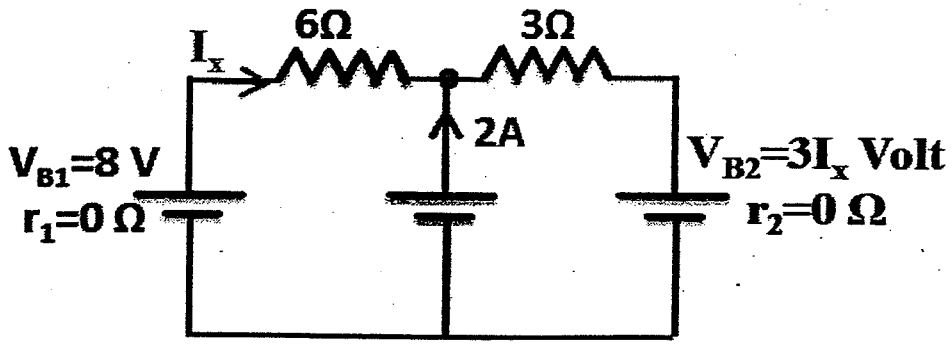
1- The magnetic flux density (B)

2- The magnetic force acting on the wire when $\theta = 30°$

[Added] Egypt 1989: An AC series circuit consists of a condenser of reactance 80 Ω, a coil of inductance 0.28 H, a resistance wire 12 meters long and cross sectional area 7×10^{-4} m^2. And the resistivity of its material is 35×10^{-5} Ω.m. and an AC mains of frequency 50 cycles/s and of effective e.m.f of 20 V find;

1) The maximum Current in the circuit.
2) The p.d across the terminals of each of the condenser and the coif.

[Added] For the circuit shown calculate I_x .



2010 First Session

Question (1)

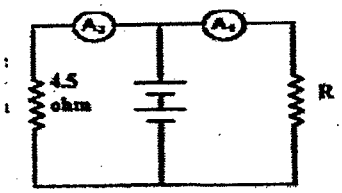
C- In the electric circuit shown in figure:

The reading of the ammeter (A) = 1 ampere.

The reading of the ammeter (A) = 2 ampere.

The internal resistance of the battery = 1 ohm **Calculate:**

1. The resistance (R). 2. The emf (V_B) of the battery.



Question(2)

A- State ONE application only for each of the following:

3. Eddy Currents.

B- A straight wire of length *(L)* is placed perpendicular to a uniform magnetic field of flux density (B). The wire is moved in a direction normal to the field at velocity (v). **Draw the figure then prove** that the magnitude of the induced emf in this wire is given by the relation: emf= B.L.V

Question (3)

A- Choose the correct answer from those between brackets:

1. A conductor of uniform cross-section, its length 20 m and its resistance 108 Ω. Another conductor of the same material its length 5 m, and of cross-sectional area equals three times the cross sectional area of the first. The resistance of the second conductor equals.....

[9Ω, 27Ω, 84Ω]

3. A transformer is used to step up voltage from 120 V to 3000 V, if the current passes through its primary coil is 2A and the current passes through its secondary coil is 0.06A. So the efficiency of the transformer is.....

(85% , 80% , 75%)

Question (4)

B- Explain the scientific idea for each of the following:

2. Moving coil galvanometer

C- A coil of .a dynamo consists of 70 turns, each of area 4 $x10^{-2}$ m^2. The coil rotates with velocity 3600 revolutions / minute' in a magnetic field of flux density of 0.5 tesla . The coil starts the motion from the position at which its plane was normal to the field, **calculate:**

1. The maximum emf.

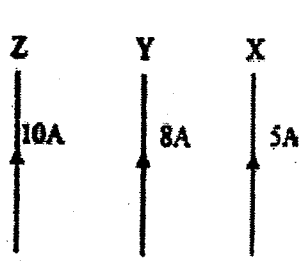
2. The emf after $\frac{1}{720}$ second from starting motion.

Question (5)

A- Mention ONE use only for each of the following:

4. The hollow cylinder which is split in two insulated halves in the electric generator.

C- The given figure represents three straight parallel wires X, Y and Z each of length 1 m. The wires carry a current of 5A, 8A and 10 A respectively in the directions shown. If the wire Y is 0.05 m away from each of the wires X and Z. Calculate the magnetic force acting on the wire Y.



(Knowing that $\mu_{air} = 4\pi \times 10^{-7}$ weber / A.m]

Question (6)

B- Mention the physical quantities which are measured by the following units:

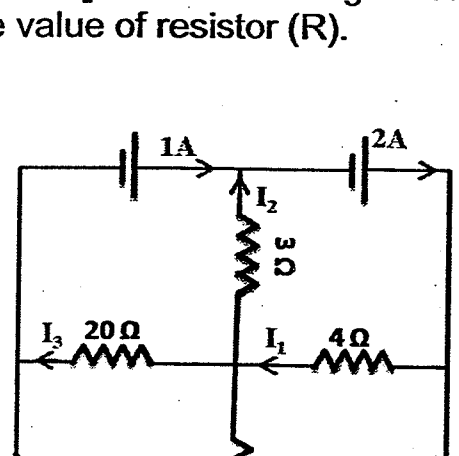
3-V.s

[Added] Al-Azhar, 1989: An electric circuit consists of an AC mains of 100 V and frequency 50 Hz, connected in series with a resistor of resistance 25 Ω an inductor and a condenser of capacity 100 μF. If the current and the voltage have the same phase, find:

a) The inductive reactance of the inductor.
b) The current intensity in the circuit.

The phase angle

[Added] In the shown figure calculate the currents I_1, I_2, I_3 and I_4 and also find the value of resistor (R).



2010(Second session)

Question (1)

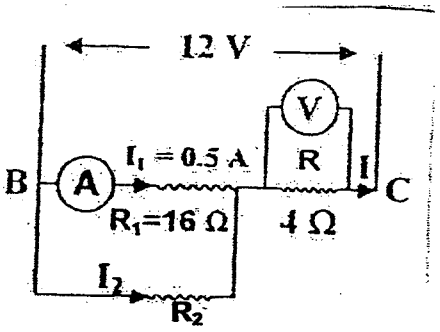
(A) What do we mean by saying?

2-The effective value of alternating current = 2 A.

Question (2):

(A) Mention one application only for each of the following:

4- Mutual inductance between two coils.



(c) The figure represents a part of an electronic:

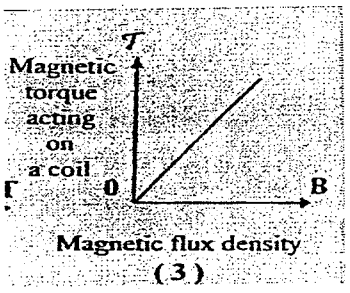
1- The reading of voltmeter (v).

The value of the resistance (R_2)

Question (3):

(A) Give reason for each of the following:

1- In the moving coil galvanometer, the permanent poles of the magnet are curved.



(B) Deduce what the slope of each line equals to in the following cases:

Question (4)

(A) Define each of the following:

2-Potential difference acrosse two points.

(B) Mention two factors only on which each of the following depends:

1-The coefficient of self induction of a coil.

3-The magnetic flux density at a point on the axis of a solenoid carrying an electric current.

(C) A moving coil galvanometer, the resistance of its coil is 18 ohm. Calculate:

1- The value of the shunt resistor needed for passing $\frac{1}{3}$ of the total current through the galvanometer's coil.
2- The value of the multiplier needed to make the galvanometer useful for measuring potential difference equals to ten times of that across the ends of its coil.

Question (5):

(A) Choose the correct answer from those between brackets in each of the following:

2-When the number of turns in the dynamo's coil doubled and its angular velocity (ω) decreases to its quarter, the maximum electromotive force generated from it .....

(Increases to the double , decreases to its half value , remains constant)

(C) A step down transformer, the number of turns of its primary coil is 5000 turns and the number of turns of its secondary coil is 250 turns. If the primary coil voltage is 240 volt.

1- **Calculate** the induced electromotive force generated between the two ends of its

secondary coil.

2- If a back induced electromotive force of 4 volt is generated in the secondary coil when the current passing through the primary coil changes by a rate of 5 Ampere / second, calculate the coefficient of mutual indication between the two coils.

Question (6) :

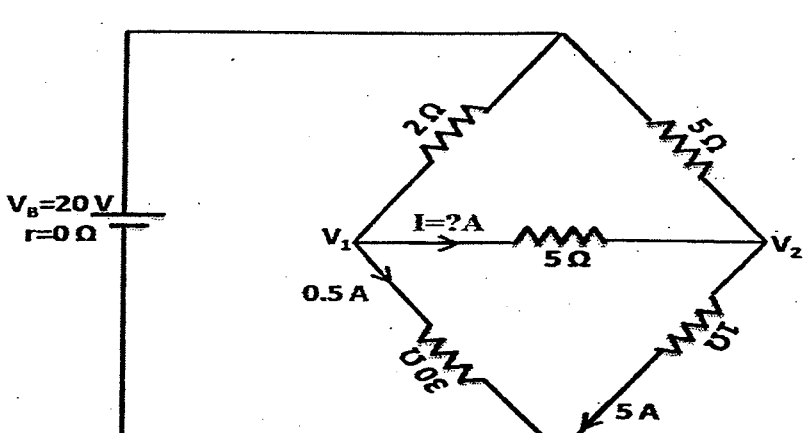
(A) First: mention the idea of working for each of the following:

2- electric motor

[Added] Eypt1990: An AC series circuit consists of a condenser of capacity 700/22 μF a resistor of resistance 50 Ω, an inductor and an AC source of frequency 50 Hz. If the potential difference across the terminals of the inductor is equal to that across the condenser = 20 V **find :**

1. The inductance of the inductor.
2. The current intensity in the circuit.
3. The maximum e.m.f of the source.
4. The phase angle between V and I.

[Added] In the shown circuit Calculate the current (I) and the electrical potential (V_1) and (V_2).



2011(First session)

Question (1):

A – Mention one use for each of the following:

3- The electric motor.

4- The multiplier resistor in voltmeter.

B- Explain the scientific idea on which the function of the following is based:

3- Induction furnaces

Question (2):

B- Write down the equivalent unit of the following and mention the physical quantities that are measured by each of them:

1- Henry 3- Weber / m^2

C – A step down transformer of 100 % efficiency, has 600 turns on its secondary coil used to operate a device of power 48 watt and potential difference 24 volt, using an electric source of e.m.f 200 volt. Calculate:

1- The number of turns in the primary coil.

2- Current intensity in the secondary coil.

3- Current intensity in the primary coil.

Question (3)

A- Write down the scientific concept for each of the following:

2- scale deflection per unit current intensity through the coil of the galvanometer.

B- Mention the factors effecting the force acted on a straight wire carrying current in a normal magnetic field then:

1-Wrirte the mathematical relation between the force and these factors.

2- Deduce a definition for magnetic flux density.

Question (4):

A- Mention the necessary condition for the occurrence of each of the following:

4- Vanishing of the induced current in a straight wire moving in a uniform magnetic field.

B- Compare between each of the following:

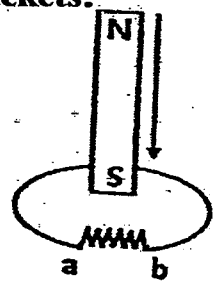
1- Fleming's left hand rule and Ampere's right hand rule (with respect to application).

Question (5) :

A- Choose the correct answer from those between brackets:

3- In the opposite figure ,if the bar magnet is being moved towards the loop ,the potential of point (a) should be ..... the potential of point (b).

(greater than – less than – equal to)

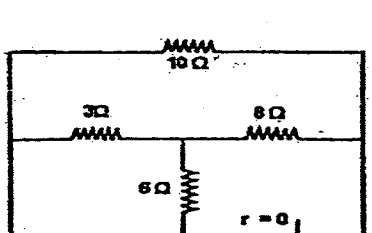


C- From the shown circuit, Calculate:

1- The equivalent resistance of the circuit.

2- The Total current intensity passing through The circuit.

3- The electric current intensity passing through 6 Ω



Question (6):

A- What are the implication of each following?

3- Passing of electric current in the same direction in two parallel wires.

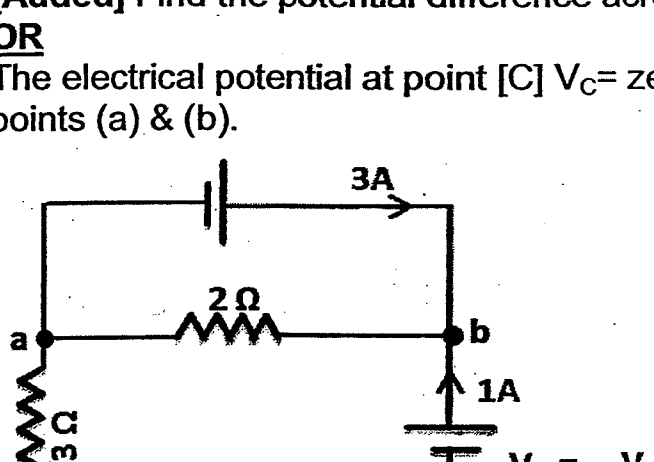
4- The replacement of two metallic rings by a metallic cylinder split into two insulated halves in dynamo.

[Added] Al-Azhar, 1990: A tuning circuit of frequency 6×10^5 Hz consists of a condenser of capacity 50 μF and a coil. If the coil is replaced by another one of inductance 6 times that of the first one and the capacity of the condenser is increased by 25 μF, find the frequency of the circuit in this case.

[Added] Find the potential difference across the3Ω resistor; and find V_{B2}

OR

The electrical potential at point [C] V_C= zero, Find the electrical potential at points (a) & (b).



2011(Second session)

Question (1):

(A) Write down the scientific term for each of the following:

3-The resistance of a wire of length 1 m and cross – section 1 m^2 at constant temperature.

(B) Compare between each of the following:

1- Coefficient of self – induction and coefficient of mutual induction with respect to their formulas applied.

2- Step up voltage transformer and step down voltage transformer with respect to the number of turns in primary coil in each.

3- Ampere's right hand rule and right hand rule for Fleming with respect to the application.

Question (2):

(A) What's meant by ....?

1- The electrical conductivity of a conductor = $1.5 \times 10^8 = \Omega^{-1} m^{-1}$.

3- The effective value of the current intensity = 0.5 Ampere.

(C) A C dynamo has 100 turns on its coil, each of area 0.05 m^2 rotates in a magnetic field its density 0.1 Tesla to generate a maximum induced electromotive force =157 volt (given that $\pi = 3.14$) ,Calculate:

1- The angular velocity.

2- The frequency of the generated current.

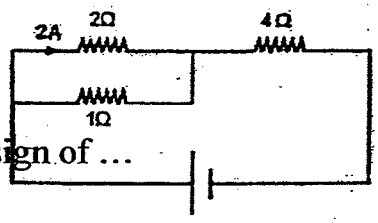
3- The average induced e.m.f . after 1\4 cycle from the maximum position.

Question (4) :

(A) Choose the correct answer from those between brackets:

3-From the illustrated circuit, the potential difference through 4 Ω .....

(20volt – 10 volt – 24 volt)



4- One of the benefits of eddy currents, they are used in the design of ...

(induction furnaces – galvanometer - dynamo)

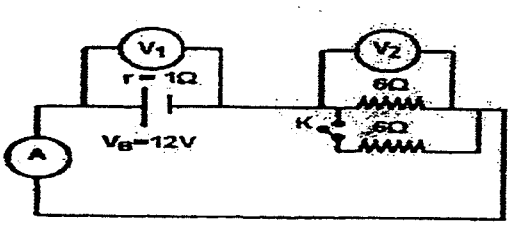
(C) The resistance of the coil of a sensitive galvanometer is 40Ω ,deviates to full scale deflection at 5 mA . Calculate the value of resistors and Describe the way of connection with the galvanometer to measure:

1- Maximum current intensity of value 20 ampere.

2- Maximum potential difference of value 10 volt.

Question (5) :

(C) In the circuit shown in the opposite figure, find the reading of (A), (v_1) **and** (v_2) when the key (k) is closed .



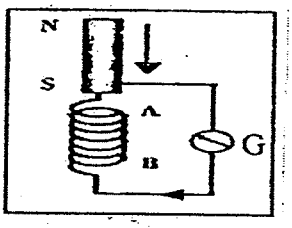
Question (6):

(B) From the shown electric circuit :

1- What type of magnetic **pole** is produced in terminal **(B) of** the coil ?

2- What is the effect of **putting** the soft iron Cylinder inside the **value of** the instantaneous deflection of the **galvanometer** ?

3- What is the name of **the rule** which determine the direction of this **current in the** coil ?

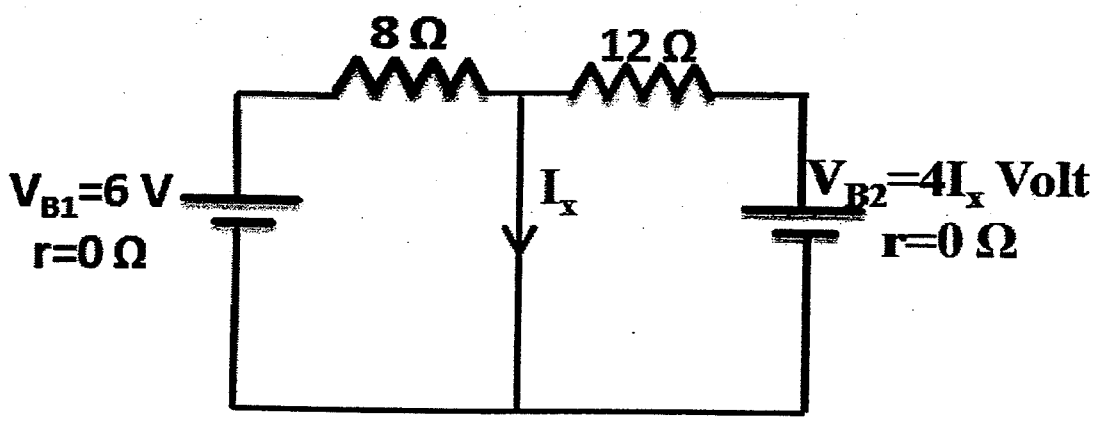


[Added] Egypt 1991:

A current of 1A passes in a coil connected to a battery of e.m.f 12 volts. When this source is replaced by an AC one of frequency 50 Hz and has the same e.m.f as that of the direct source, the current intensity became 0.6 A only When a condenser is connected with the coil in series, the current intensity returns back to its original value (1A) find :

1) The inductance of the coil.
2) The capacity of the conductor.
3) The phase angle between the current and the alternating voltage.

[Added] Find V_{B2} in the illustrated circuit



2012 (First session)

Question [1]

(A)Mention one application for each of the following:

3-Mutual induction between two coils

(B)Compare between each of the following:

1-Resistance and resistivity (with respect to their units)

Question [2]

(A)What is meant by ...?

3-The effective value of the alternating current

(C) A moving coil galvanometer of resistance 5 Ω gives full scale deflection when a current of intensity 20mA flows through it, calculate:

1-The maximum current measured when it is connected to a shunt resistance of 0.1 Ω

2-The multiplier resistance connected with the galvanometer to convert it to voltmeter of maximum potential difference 5V

Question [3]

(A)Write down the scientific term for each of the following:

1-The Magnetic flux density, which will exert a force of one Newton on a current carrying wire of one meter length perpendicular to the field when the current intensity is one ampere

4-The induced current must be in a direction such as to oppose the change producing it

(B)Give reason for each of the following:

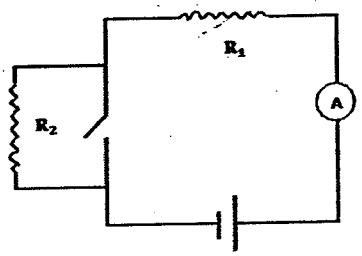
2-The electric transformer cannot be used to step-up or step-down direct voltages

Question [4]

(A)Choose the correct answer from those between brackets:

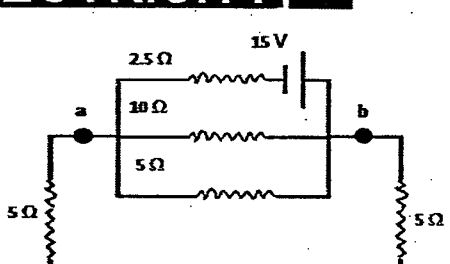
1-In the shown electric circuit, on closing the Key, the reading of the ammeter .....

(Increases – Decreases – Doesn't change)



(B)Mention only TWO factors affecting each of the following then write down the mathematical of formula for each:

1-Torque acting as a rectangular oil carrying current placed such that its plane is parallel to a uniform magnetic field



(C)In the shown electric circuit, calculate:
1-The total resistance of the circuit
2-The total current intensity that passes in the circuit
3-The potential difference across a & b

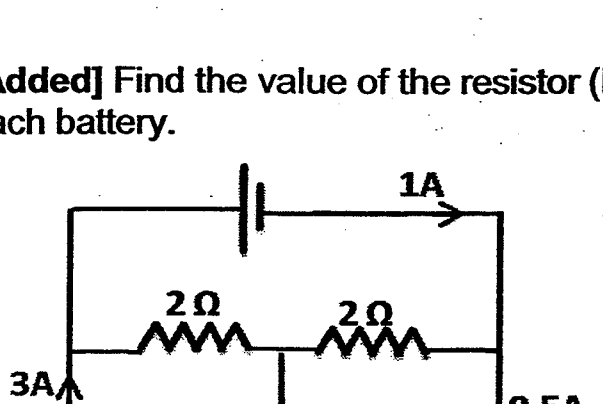
Question [5]
(A)When does each of the following values become equal to zero?
3-The magnetic flux density at a point between two parallel wires each carrying electric current

Question [6]
(A)Write down only two characteristics for each of the following:
2-Lines of magnetic flux at the center of circular loop carrying current

(B)Write the equivalent unit and mention the physical quantity used to measure each of them:
Cycle/sec Volt.sec Ohm.sec

[Added] Al-Azhar, 1992:
An AC series circuit consists of an AC mains [200 V-50 Hz], a condenser of capacity $\frac{100}{3\pi}$ μF and a filament lamp [25 W - 100 V]. Will the lamp operate normally or will its filament be melted?

[Added] Find the value of the resistor (R) and the potential difference across each battery.



2012 (Second Session)

Question [1]

(A) Mention one condition to get each of the following:

4-Torque acting on a rectangular coil carrying current placed in a magnetic field is equal to zero.

Question [2]

(A) Compare between each of the following:

1-Shunt resistor and multiplier resistor (with respect to connection method with the galvanometer).

Question [3]

(A) What's meant by .....?

1-Electric conductivity of a material.

2-Coefficient of self induction of a coil.

(C) The alternating induced electromotive force that produced due to the rotation of a coil in a magnetic field is given by the relation. emf = 180 sin 18000 t **Calculate:**

1-The effective induced electromotive force.

2-The frequency.

3-The induced electromotive force after 5 millisecond from the position at which the plane of the coil is perpendicular to the magnetic field.

Question [4]

(A) Choose the correct answer from those between brackets:

4-When the length of a copper wire is doubled, and its cross section decreases to its half, its resistance ..... (is doubled - decreases to its half - increases 4 times)

(B) Explain the scientific idea for each of the following:

1-Induction furnaces.

3-Electric motor.

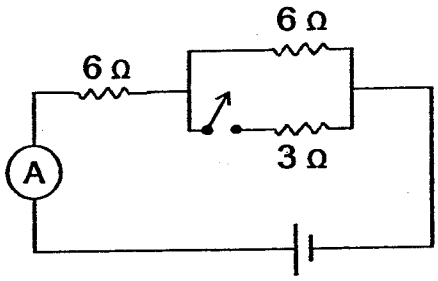
Question [5]

(A) Give reason for each of the following:

1-Using step-up voltage transformers at electric power stations.

4-The continuity of rotation of the electric motor in the same direction.

(C) In the illustrated circuit the reading of the ammeter = 2 amperes, when the key is closed the reading becomes 2.8 amperes. Calculate:



1-The internal resistance of the battery.

2-E.M.F. of the battery.

Question [6]

(A) Mention one use for each of the following:

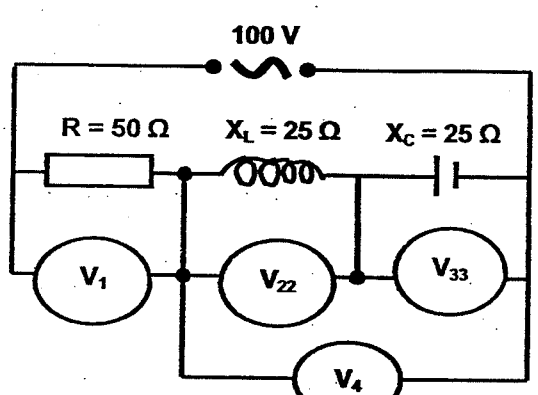
3-The Ohmmeter.

(C) A metal wire of one meter length carrying current 10 amperes in a magnetic field of density (), the table illustrates the relation between the force acted on the wire in Newton (F) and sine the angle between the field and the wire ().

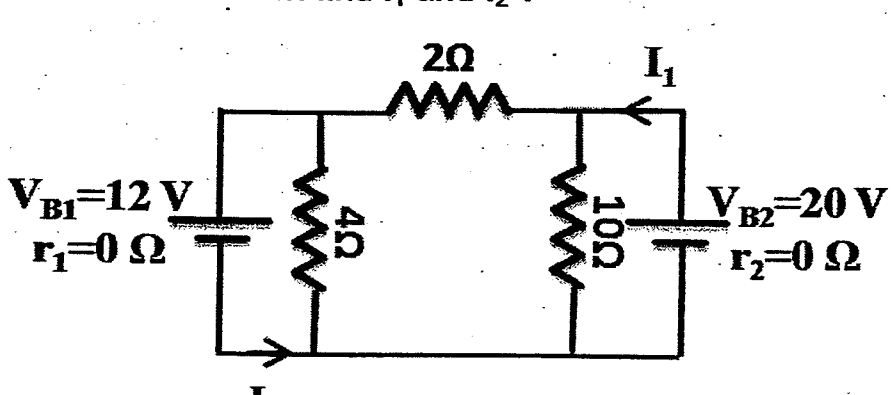
F(N)	0.2	0.4	0.6	0.8	1	1.2
Sin θ	0.1	0.2	0.3	0.4	0.5	0.6

Draw the graphical relation between the force (F) in Newtons on the vertical axis and (sin θ) on the horizontal axis.
From the graph, find:
1-The force affecting the wire when it becomes perpendicular to the magnetic field.
2-The magnetic flux density.

[Added] Egypt 1993: Using the illustrated circuit and the given information, find the reading of each of the four voltmeters.



[Added] For the circuit shown find I_1 and I_2 .



2013 (First session)

Question[1]

Firstly: What is the scientific idea on which operation of each of the following depends?

1- The electric transformer.

Secondly:

(A)State two factors only on which each of the following depends:

2-Magnetic dipole moment.

Question [2]

Firstly: What is meant by?

3-Self-induction coefficient of a coil = 0.5 Henry

Secondly:

(A) Compare between each of the following:

3-Ampere's right hand rule and Fleming right hand rule with respect to the use of each.

(B) A copper wire of length 50.24 m and cross sectional area 1.79×10^{-7} m^2 is wound as a circular coil; its number of turns is 200 turn each of radius 4cm. Its two terminals are connected to a direct current source of electromotive force 12 volt and internal resistance 1 Ω . If you know that copper resistivity is 1.79×10^{-8} Ω.m, π = 3.14, $\mu = 4\pi \times 10^{-7}$ web/A.m.

calculate:

1-current intensity flowing through the wire.

2-magnetic flux density at the center of the coil.

Question[3] (10 marks)

Firstly: What are the results of...?

4-Switching off an electric circuit of a strong electromagnet coil connected in series to a battery and a switch.

Secondly:

(B) An alternating current dynamo has a coil of 200 turns of mean dimensions [30cm, 40 cm]. If it rotates in a uniform magnetic flux with frequency $\frac{50}{\pi}$ cycle/sec, an effective emf = 141.4 volt is produced.

Calculate:

1- Maximum value of the produced electromotive force.

2- Magnetic flux density affecting the coil.

3- average emf produced through $\frac{1}{4}$ cycle from the position in which the coil plane is perpendicular to the field, $\pi = 3.14$

Question[4]

Firstly: Explain each of the following:

1-The equivalent resistance of a group of resistors connected in parallel decreases.

Secondly: Write down the physical quantities that measured by the following units and mention an equivalent unit for each:

1- N/A.m 2- J/Hz 3- Tesla.m^2/s

Question[5]

Secondly:

(B)A sensitive galvanometer of coil resistance 50 Ω , gives full scale deflection at current intensity 40 mA. It is desired to be used as an ohmmeter using a standard resistor and an electric cell of electromotive force 3 volt. (of negligible internal resistance). Calculate:

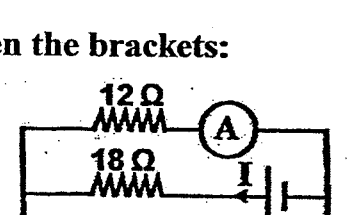
1-the value of the standard resistance .

2-the external resistance needed to make the pointer deflect to 1/4 its full scale.

Question[6]

Firstly: Choose the correct answer from those between the brackets:

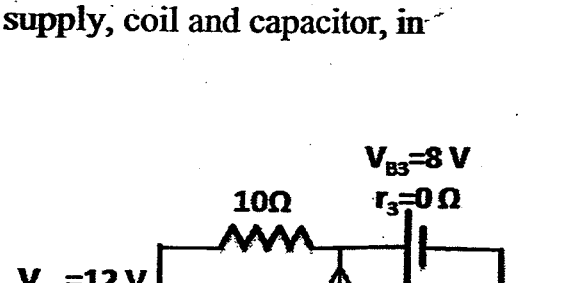
1-In the shown circuit, the ammeter reading equals..... (I - I/2 - I/3)



[Added] Egypt, 1995: A battery of e.m.f. 12 volts is connected in series to an inductive coil. The current flowing is 2 Amp. If the battery is replaced by an AC source of an effective value of 12 volts, the current flow will be 1.2 Amp. When a capacitor is connected in series to the coil in the second circuit, the current intensity increases to its value in the first circuit (2 Amp). Neglecting the internal resistance of the power sources. Calculate:

a) The ohmic resistance of the coil.
b) The inductive reactance of the coil.
c) Is the last circuit, consisting of the AC supply, coil and capacitor, in resonance or not? Why?

[Added] Calculate the voltages (V_{B2}) and the potential difference across 40Ω resistor in the illustrated circuit



2013 Second Session

Question (1)

[A]What is meant by each of the following?

2-The intensity of electric current is 0.3 Ampere

3-Resistivity of material = 5×10^{-7} Ohm.m

4-The effective value of the A.C current = 5 Ampere

[B] First: What is the scientific idea on which operation of each of the following depends..?

1-Alternating current dynamo 2-Electric motor

Second: Explain with drawing an experiment to demonstrate the mutual induction between two coils and how can you generate induced current in the secondary coil

[C] A solenoid consisting of 400 turns, each of crosses sectional area 4 cm^2 is placed perpendicular to a uniform magnetic field of flux density 0.3 Tesla. Calculate the average induced electromotive force generated in the solenoid when:

1-The magnetic flux density increases to 0.5 Tesla through 2 millisecond

2-The magnetic flux density decreases t0 0.2 Tesla through 2 millisecond

Question [2]:

[A] Compare between each of the following:

2-Fleming right hand rule and Fleming left hand rule with respect to the use of each

Question [3]

[A] Write down the scientific term for each of the following statements:

1-A very high resistance joined in series with the moving coil galvanometer, to convert it to voltmeter

[B] First: Mention only one factor affecting each of the following physical quantities and mention the mathematical relation:

1-Resistance of a wire

2-Magnetic flux density at the center of a circular coil

Second: Choose the correct answer:

1-If the electromotive force of a source is 12V, the potential difference across its two terminals when current flowing in a closed circuit is.....12V

(Less than – more than – equal to)

2-The torque acting on a coil carrying a current in a uniform magnetic field becomes maximum when the plane of the coil is

(Perpendicular to – Parallel to – inclined by an angle 30° to) the direction of the magnetic field

3-The existence of a cylinder made of soft iron in the moving coil galvanometer make the magnetic flux lines in the shape of

(Straight lines – circles – radial)

[C] An electric current of intensity 5A flows through a straight wire. Calculate the magnetic flux density produced, at a point in air of perpendicular distance 10 cm from the wire. If another wire of length 50 cm carries an electric current of intensity 2A, is placed at the point. Calculate the force acting on this wire as it is affected by the field ($\mu - 2 \times 10^{-7}$ weber/A.m)

Question [4]:

[A] Mention one use only for each of the following:

1-Shunt resistance

[C] A copper wire of length 50.24 m and cross sectional area 1.79×10^{-7} m^2 is wound as a circular coil; its number of turns is 200 turn each of radius 4 cm. Its two terminals are connected to a direct current source of electromotive force 12 volt and internal resistance 1Ω. If you know that copper resistivity is 1.79×10^{-8}Ω.m,

(π=3.14Ω.m, $\mu=4\pi \times 10^{-7}$web/A.m)

Calculate:

1-Current intensity flowing through the wire

2-Magnetic flux density at the center of the coil

Question (5):

[A] Give reasons for each of the following:

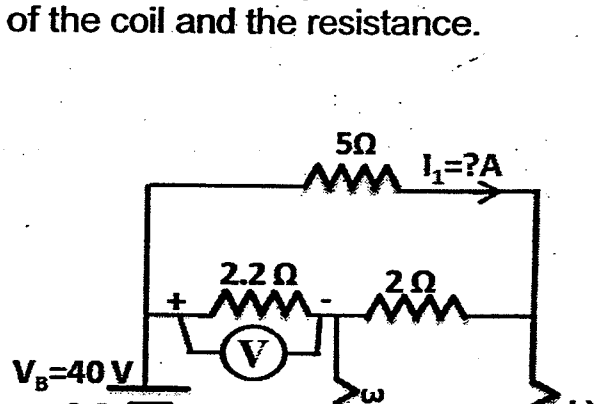
1-The ohmmeter is joined with a fixed resistance and a variable resistance

2-Transormer cannot operate using direct e.m.f

3-There is no ideal transformer (Of efficiency 100%)

[Added] Al-Azhar, 1995: A coil of negligible ohmic resistance and of inductance 1 Henry is connected in series with an ohmic resistance of 300 Ω and AC mains of e.m.f. 200 V and frequency 700/11 HZ. Find the potential difference across the terminals of each of the coil and the resistance.

[Added] In the illustrated circuit, Calculate the current (I_1) and the reading of the voltmeter.



2014 First Session

A- Mention the scientific idea of each of the following:

1-Electric transformer 2-Induction furnaces 3-Direct current ammeter

[B] First: What is meant by each of the following?

1-Electric conductivity of material

Second: Give reasons for each of the following:

1-The two poles of the permanent magnet in the sensitive galvanometer are concave

2-Equality of the electric potential difference across the two poles of an electric cell and its electromotive force when no current flows through its circuit

[C] A sensitive galvanometer of coil's resistance 50Ω, gives full scale deflection when a current 0.002A flows through it, it is connected to a multiplier resistance of 450Ω to convert it into a voltammeter, what is the maximum range of such voltmeter? If it is desired to use the voltmeter to measure the electric current intensity by connecting it with a shunt resistance 0.1Ω, what is the maximum current intensity that can be measured by it?

Question [2][A] Write the scientific term of each of the following:

1-A flow of electric charges in a conductor

2-The scale deflection per unit current intensity flowing through the coil of a galvanometer

[B] First: Mention one factor only from the factors that affect each of the following:

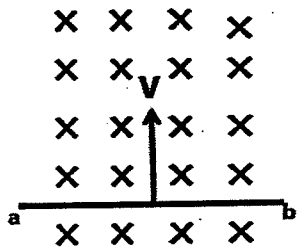
1-The magnetic force acting in a straight wire carrying an electric current placed perpendicular to a uniform magnetic field

2-The coefficient of self induction a coil

Second: Compare between each of the following:

1-Ampere's right hand rule and Fleming's left hand rule (concerning the use of each)

[C] The opposite figure shows a metal rode (ab) of length 0.25m moving with a linear velocity 2 m/sec perpendicular to a magnetic field of flux density 0.4 Tesla and its direction is perpendicular to the paper inwardly:



1-Determine the direction of the current in the wire

2-Mention the name of the rule used to determine the direction of the current

3-Find the magnitude of the induced electromotive force in the wire

Question [3]

[A] Mention one use only for each of the following

1-The ohmmeter 2-Lenz's rule

Second: By using the following physical units, from three groups of equivalent units then state the physical quantity measured by each group:

1-Kg.m^2/s	2-V.s/A	3-Tesla.m/A
4-V.s/A.m	5-Ω.s	6-J.s

[C] An electric circuit contains four electric resistors (R_1, R_2, R_3, R_4) Ohm, if the electric current intensity that flows through each of them is (0.3, 0.3, 0.4, o.2) Ampere respectively and the value of $R_1 = 6\Omega$, $R_3 = 15\Omega$ and the internal resistance of the battery 1Ω

1-Show by drawing the method of connection of these resistors

2-Calculate the total resistance of the circuit

3-Calculate the electromotive force of the electric source

Question (4)

[A] When does each of the following values equal zero?

1-The torque acting on a coil through which an electric current flows and placed in a uniform magnetic field

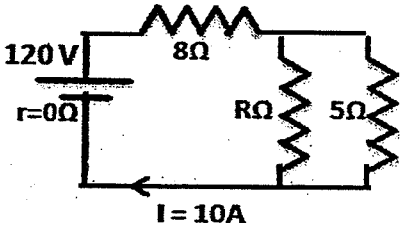
3-The total magnetic flux density at a point outside two straight parallel wire carry electric current

4-The average electromotive force induced in a coil rotating in a uniform magnetic field

[B] First: Choose the correct answer between brackets:

1-In the opposite circuit the value of R =.....Ω

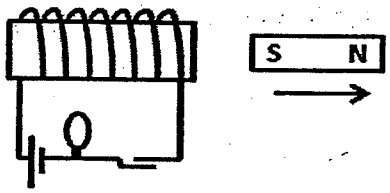
(20 – 40 – 60)



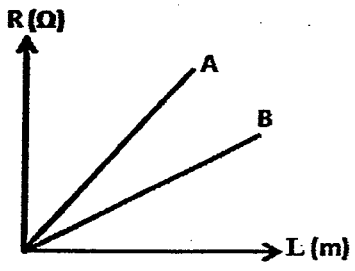
2-In the opposite figure:

When the magnet moves in the direction shown the intensity of illumination of the lamp.....

(Increases – decreases – vanishes)



Second: The opposite graph represent s the relation between the electric resistances (R) and the length (L) for two wires (A and B) of different materials having the same cross sectional area



1-Which one of the two wires has greater specific resistance? and why?

2-If the two wires are connected together in parallel in an electric circuit, which one of them carries greater electric current? and why?

[C] An A.C. dynamo its coil consists of 420 turn, the cross-area of each $3 \times 10^{-3} m^2$ rotates in a magnetic field of flux density 0.5 Tesla, if the coil starts rotating from the position perpendicular to the flux lines and reaches to maximum induced electromotive force after 1/200 sec (given that b=22/7) calculate:

1-The maximum induced electromotive force

2-The time needed for the current to reach half its maximum value

Question (5):

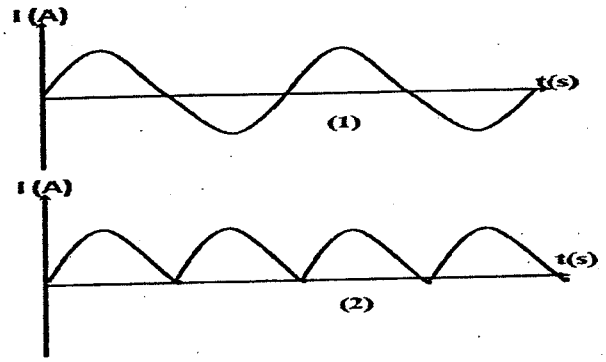
[A] What are the results of each of the following?

1-Flowing of electric currents in two opposite directions through two straight parallel wires close to each other

3-Flowing of direct electric current through a solenoid

Second: Figure (1) shows the resultant current through the external circuit of an electric generator

Figure (2) shows the resultant current through the external circuit of the same electric generator after making a certain modification



1-Whate is the difference between the two currents?

2-What is the modification made on the electric generator?

3-Why can't the ammeter be used to measure the resultant current in both figures?

[C] An electric transformer of a changeable number of secondary coil turns (N_s) is used to obtain different values of output potential difference (Vs), the following table shows the relation between V_s on the y-axis and (N_s) on the x-axis

From the graph find:

V_s (volt)	48	96	120	144
N_s (turn)	50	100	125	150

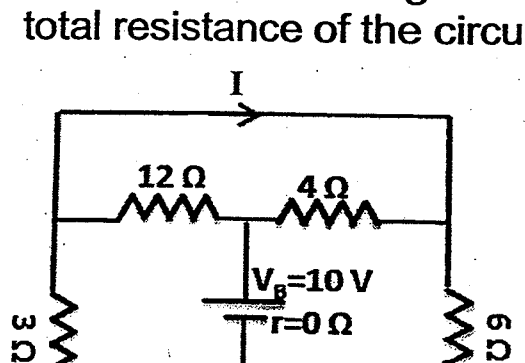
1-The slope of straight line

2-The resultant power from the secondary coil when its number of turns becomes (N_s = 200 turn) and the resistance of its circuit is 75Ω

[Added] An AC circuit consisting of a resistance 100 Ω, a coil of inductive reactance 125 Ω and a capacitor of capacity (C) microfarad , connected in series to a (220V, $\frac{280}{11}$ Hz) AC supply ; **Calculate:**

1. The value of (C) which maximizes the current intensity in the circuit.
2. The potential difference across each of the coil and the capacitor

[Added] In the shown figure calculate the current (I) and also the total resistance of the circuit.



2014 Second Session

Question (1)

[A] Mention the name of one device whose scientific idea is based on the following:

1-Coefficient of self induction 2-Eddy current

3-Magnetic effect of the electric current

Second: Mention the scientific term that represents the following statements:

1-The magnetic flux density that exerts a force of 1N on a wire of length 1m carrying an electric current of intensity 1 Amp. When placed perpendicular to the field

2-The ratio between the resultant (output) powers to the input power in a electric transformer

[C] A sensitive galvanometer its coil consists of 100 turn, the cross sectional area of each is 5 cm^2 and its pointer deflects to the end of its scale when an electric current 0.4 mA flows through it, given that the magnetic flux density that affects it is 0.4T and the plane of the coil makes an angle 60° with the flux line. Calculate each of the following:

1-The magnetic torque that affects the coil

2-the resistance of the galvanometer's coil, if it is connected to a multiplier resistor 4000Ω to act as a voltmeter measures a potential difference of maximum value 5V.

Question [2]:

[A] Compare between each of the following:

1-The shunt resistor and multiplier resistor (concerning their function with the galvanometer)

Question [3]

[A] What is meant by each of the following?

1-Magnetic dipole moment 2-The electromotive force of an electric source

[B] First: Mention one factor only from the factors upon which each of the following depends:

1-Resistivity of conductor 2-The electromotive force induced in a coil

Second: Prove that the induced electromotive force generated between the terminals of wire moves perpendicular to a uniform magnetic field is determined from the relation e.m.f = -BLV

[C] A solenoid of 100 turns and cross sectional area 5 cm^2 is placed perpendicular to a uniform magnetic field of flux density 0.2T. Calculate the average induced electromotive force in the solenoid in the following cases:

1-If the solenoid is revolved a quarter revolutions within 0.1 sec

2-If the solenoid is turned upside down within 0.2 sec

3-If the magnetic flux density is decreased to 0.1T within 0.1 sec

Question [4]:

[A] What are the results of each of the following...?

1- Closing the circuit of the primary coil of a transformer while the circuit of the secondary coil is opened

2-Increasing the length of a conductor to double its value with decreasing its diameter to half its value

3-The absence of a variable resistor in the ohmmeter

[B] First: Choose the correct answer from these between brackets:

1-The magnetic torque acting on a coil carrying an electric current and placed in a magnetic field is maximum when the plane of the coil is
(Perpendicular to the field – Parallel to the field – making angle 30° with the field)

2-The average value of the electromotive force induced in the coil of the dynamo during one complete revolution starting from the perpendicular position equals
(Its maximum value – its effective value – zero)

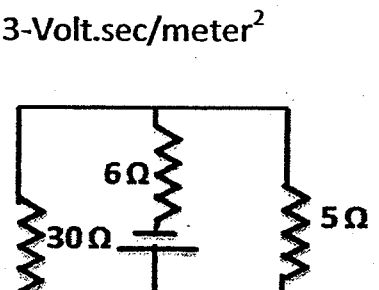
Second: Mention the physical quantity that is measured by each of the following units. Then state the equivalent unit of each:

1-Joule/Ohm. Coulomb 2-Ioule.sec/Ampere. Coulomb 3-Volt.sec/meter^2

[C] From the circuit shown in the figure calculate each of the following:

1-The equivalent resistance of the circuit

2-the electromotive force of the source given that the electric current intensity flowing through resistor 30Ω = 1Ampere. And the internal resistance of the source r=2Ω



Question (5):

[A] Give reasons for each of the following:

1-The galvanometer can't be used to measure the intensity of alternating current

2-The coils of electric transformer are made of copper

First: Explain with drawing Faraday's experiment to show electromagnetic induction

[B] Second: Mention the mathematical relation used to calculate each of the following physical quantities:

1-The maximum electromotive force induced in the dynamo

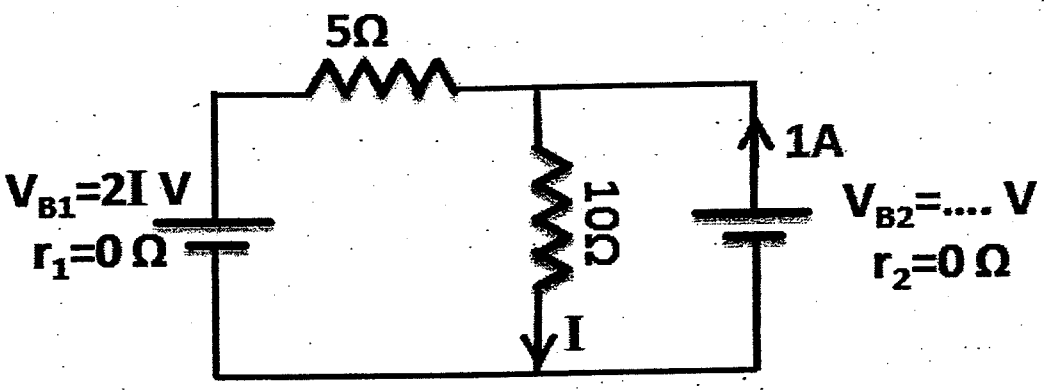
[C] A wire of length 2m and carries an electric current of intensity 1A is placed in a Uniform magnetic field of flux density 0.6 T, the following table shows the relation Between the magnetic force (F) exerted on the wire and sin the angle between the wire And the direction of the field (sinθ)

F(N)	0.6	1.2	1.5	1.8	2.7
Sin (θ)	0.2	0.4	0.5	0.6	0.9

Draw a graph relating the force exerted on the wire on the y-axis, and sinθ on the x-axis
From the graph find:
1-The force exerted on the wire when placed perpendicular on the field
2-The electric current intensity flowing through the wire

[Added] When an inductive coil is connected to a DC Supply of 6 volt and of internal resistance 1 Ω a current of 1.5 Ampere flows. When the source is replaced by an AC supply of 5 volt and of frequency 49 Hz the current flowing in the same coil is 1 Ampere. Calculate the self-inductance of the coil.

[Added] Find V_{B2} in the illustrated circuit



PHYSICS PREVIOUS EXAMS [ELECTRICITY]

2015 First Session

Question (1)

[A] Mention one use for each of the following:

1-Voltammeter 2-Eddy currents 3-Mutual induction between two coils

4-Magnetic torque

[B] First: What is meant by .....?

1-The electromotive force of a source

Second: How do you explain each of the following?

1-The wavelength of the wave accompanying the electron motion decreases by increasing its velocity

2-The ohmmeter scale is opposite to that of the ammeter

[C] The potential difference across the primary coil of an ideal transformer is 240V.If the number of turns of its secondary coil is duple that of the primary coil and the intensity of current flowing through the primary coil is 3A

1-Mention the type of such transformer

2-Calculate each of the following:

a-The potential difference across the secondary coil

b-The intensity of current flowing through the secondary coil

c-The produced electric power

Question [2]:

[A]Write the scientific term for each of the following statements:

1-The induced current must be in a direction such that to oppose the change producing it

2-The magnetic flux density which exerts a force of one Newton on a current carrying wire of one meter length perpendicular to the magnetic field when the current is 1 ampere

5-The spectrum that consists of all wavelengths or frequencies in a definite range

[B] First: what is the mathematical relation for...?

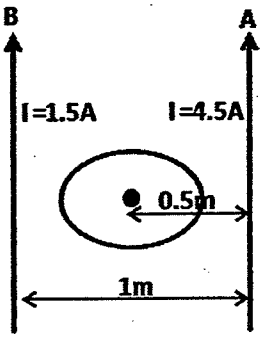
1-Ohm's law for closed circuit

Second: Compare between each of the following:

1-Shunt and multiplier resistors, concerning the way of connecting to the galvanometer

2-Right screw rule and Fleming right hand rule, concerning the use

[C] Two straights wires (A) and (B) are placed (1m) apart from each of the flowing through wire (A) is (4.5 A) and that flowing through wire (b) is (1.5 A) in the same direction. A circular coil of one turn and radius = (10π cm) is placed between the 2 wires in the same plane and its center is at a distance (0.5m) from wire (A) as shown in the figure. What are the intensity and direction of the current passing through the circular coil such that the magnetic flux density at its center = zero?



Question [3]:

[A] Mention one use for each of the following:

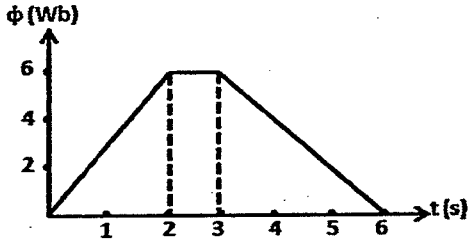
1-induction coil

[B] First: The opposite figure shows two adjacent solenoids, one of them is movable **Determine** six ways that generate an induced current through the secondary coil across the resistance R

[C] The magnetic flux that masses through a coil of 200 turns changes during 6 Seconds. Using the shown graph, calculate the induced electromotive force during:

1-The first two seconds 2-The third second

3-The last seconds



Question [4]:

[A] Choose the correct answer from those between brackets:

1-A group of equal resistors when connected in series, its equivalent resistance = 100Ω and on connecting them in parallel, its equivalent resistance = 4Ω. The value of each resistor = ...Ω (20 – 50 – 100)

2-Sensitivity of galvanometer is determined by the relation ($\theta^2/I - \theta/I - \theta/I^2$)

[B] First: Mention two factors only on which each of the following depends:

1-Magnetic flux density at a point on the axis of a solenoid carrying a current

2-The induced electromotive force in a straight wire moving in a magnetic field

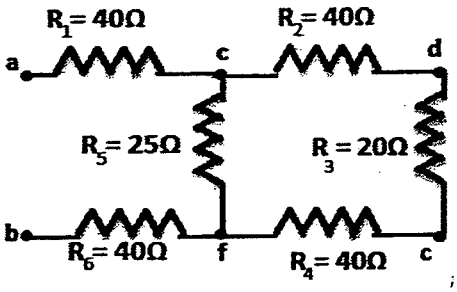
3-Mutual induction between two coils

[C] In the shown electric circuit, if the potential difference V_{ab} = 200 volt, calculate:

1-The equivalent resistance of the circuit

2-The current intensity through resistor (R_1)

3-The current intensity through resistor (R_5)



Question [5]:

[A] 1-The opposite table shown the characteristics of three Metallic conductors made of different materials x,y,z and they have the same cross sectional area

Conductor	Its length	Its resistance
X	2m	1Ω
Y	3m	4Ω
Z	3m	6Ω

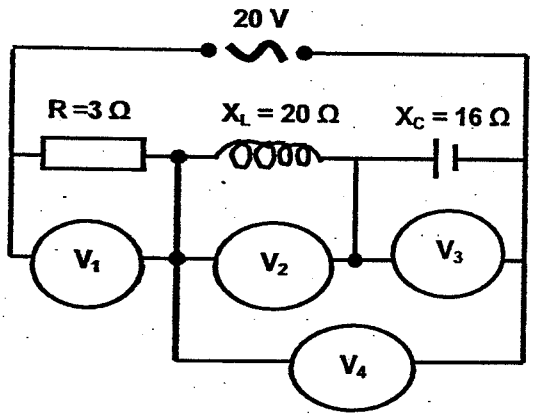
Deduce the ration σ_x ,σ_y ,σ_z knowing that σ is the electrical conductivity. Then deduce which of these materials has highest electrical conductivity

2-Mention the role of the two insulated halves of the hollow metallic cylinder connected to the two ends of the coil in each of dynamo, and motor

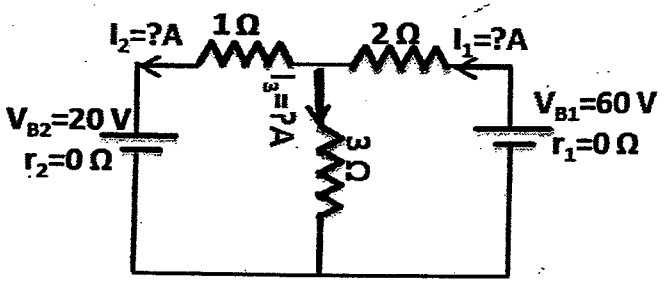
[Added] Egypt May 1999:

Using the illustrated circuit shown in figure,
calculate:

1. The total impedance of the circuit.
2. The current flowing through the circuit.
3. The reading of each of the four voltmeters.



[Added] Calculate I_1, I_2, and I_3 in the illustrated circuit.



2015 Second Session

Question (1)

[A] Mention one use for each of the following:

1-Step up transformers 2-Direct current ammeter

[B] First: When is .....? 1-The efficiency of a transformer less than 100%

Second: Compare between each of the following:

1-The magnetic flux density surrounding a straight wire carrying a direct current and that at the center of a circular coil carrying current concerning the mathematical relation

[C] The coil of an alternating current dynamo consisting of 800 turns each of area $(7/11 \times 10^{-2})\ m^2$ and moves in a uniform magnetic field of flux density 0.03 T. If the maximum induced electromotive force generated is 48V, calculate

1-The frequency of the produced current ($\pi=22/7$)

2-The value of maximum induced electromotive if the periodic time of the coil becomes 0.01 Sec

Question [2]:

[A] Write the scientific term of each of the following:

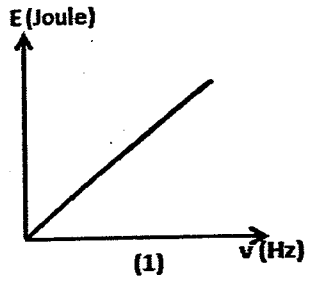
1-The self induction of a coil in which an emf of 1Volt is induced when the current passing through it changes at a rate of one Ampere per second

[B] First: What is the mathematical relation used in the calculation of:

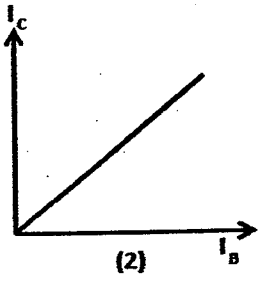
1-The multiplier resistor required to be connected in series to the galvanometer coil to convert it into voltammeter

2-The equivalent resistance for N of equal resistors connected in parallel

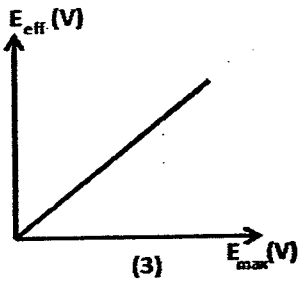
Second: Write what is represented by the slope in the following graphical relations:



(1)



(2)



(3)

[C] The full scale deflection of moving coil galvanometer from zero position is 80°.When a current of 30 mA passé, the scale deflection from zero position was 60°.calculate:

1-The galvanometer sensitivity

2-The maximum current can be carried by the galvanometer coil

3-The maximum current could be measured by the device if its coil is connected to a shunt of 0.01 its coil resistance

Question [3]

[A] Mention one application only for each of the following:

1- The ohmmeter 2-Mutual induction between two coils

3-Self induction

Second: Explain the following:

1-The scale of the ohmmeter is not uniform

[C] The secondary coil of an ideal electric transformer is connected to an electric lamp of resistance 10 ohm which consumes 3000 joule during 5 minutes. If the induced electromotive force of the source connected to the primary coil is 200 volt, calculate:

1-The electric current intensity flowing through the primary coil

2-The electric current intensity flowing through the secondary coil

3-the potential difference across the two terminals of the secondary coil and from that determine the type of such transformer

Question [4]:

[A] Choose the correct answer from those between brackets:

1-If the radius of a metallic wire is doubled and its length is halved, the electrical conductivity of the wire's material is

(Doubled – halved – kept constant)

[B] First: Mention two factor only on which each of the following depends:

1-Magnetic dipole moment

2-The instantaneous induced electromotive force of an alternating current dynamo

3-The direction of force acting on a wire carrying current placed in a uniform magnetic field

Second: What happens when.....?

1-Subjecting a metallic piece to a magnetic field due to alternating current of high frequency

2-Replacing the two metal rings in the dynamo by two halves of a hollow metallic cylinder insulated from each other

[C] You have three electric lamps of equal electric resistance. Illustrate by drawing, How they could be connected together in an electric circuit with an electric cell of negligible internal resistance such that:

1-The luminous intensity of the three lamps is maximum

2-The luminous intensity of the three lamps in minimum

Question (5):

[A] What is the role off.....?

1-The two spiral springs in the sensitive galvanometer

2-The core made of soft iron in the electric transformer

Second: Explain (without drawing) how the sensitive galvanometer is converted to be used as an ammeter. Deduce the required mathematical relation

[C] In an experiment for verification of ohm's law for a closed circuit, the obtained results for the intensity of current passing through the circuit and the potential difference across the terminals of the electric cell are shown in the following table:

V (volt)	9	8	7	6	5
I (Ampere)	1	2	3	4	5

Draw a graphical relation between the potential difference on (y-axis) and current intensity on (x-axis)

From the graph, find:

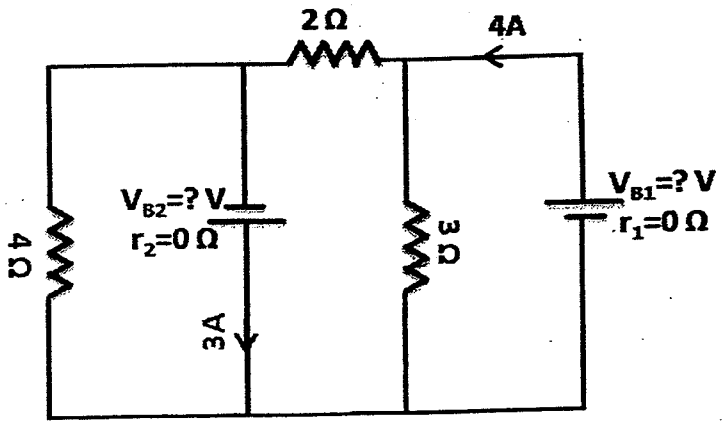
1-The internal resistance of the electric cell

2-The electromotive force of the electric cell

Calculate the equivalent electric resistance of the external circuit connected to the cell, if the intensity of the flowing current through it is 4A

[Added] Egypt August 1999:

Electro generator has a coil of 500 turns the cross sectional area of each turn = $\frac{7}{11}$ m^2. It is placed in a uniform magnetic field of magnetic flux density 5×10^{-4} Tesla. If coil rotates with frequency 50 cycle/sec, and its terminals are connected in series with a capacitor of capacitive reactance 110Ω and an inductive coil of inductive reactance 80 Ω and its Ohmic resistance 40Ω. Calculate neglecting the internal resistance of the electric generator:

1. The maximum induced e.m.f generated in the inductive coil.
2. The effective value of the current flowing through the circuit.

[Added] Using the given data on the illustrated circuit calculate the voltages (v_{B1}) and (v_{B2}).